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Exploring the Roles of Science in Implementing the Sustainable Development Goals in Africa

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Highlights

- Science enables innovation and informed policies for sustainability in Sub-Saharan Africa.
- The SDGs aim to end poverty, protect the planet, and ensure prosperity by 2030.
- Key challenges include poor infrastructure, limited education, and high poverty.
- SDG success depends on data, open research, and cross-sector collaboration.
- A systems-thinking approach is crucial for tackling interconnected SDG challenges.

Abstract

The Sustainable Development Goals (SDGs) are a set of 17 global objectives adopted by the United Nations in 2015 to end poverty, protect the planet, and ensure that all people enjoy peace and prosperity by 2030. Implementing these goals is especially crucial in Sub-Saharan Africa, where the region faces unique sustainable development challenges such as inadequate infrastructure, limited access to technology and education, high poverty rates, and low life expectancy. Science plays a vital role in addressing these challenges by developing new technologies and formulating evidence-based policy recommendations. For example, scientific research in renewable energy can increase access to electricity and reduce dependence on fossil fuels, while advances in medicine and public health can improve healthcare outcomes and lower mortality rates. This review examines the various ways in which science contributes to the implementation of the SDGs in Sub-Saharan Africa, including identifying sustainable development challenges, measuring progress towards the goals, and providing solutions. The review emphasises that collaboration among government, industry, and academic sectors is essential in harnessing the power of science to achieve the SDGs and promote sustainable development in the region.

Keywords: Sub-Saharan Africa, sustainable development goals, SDGs, science, technology, data, evidence-based policies.

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1.0 Introduction

Sustainability is a universal condition in which the growth of human civilisation is maintained within limits that ensure the balance of its social, economic, and environmental facets for both the present and future generations (Ibeh & Walmsley, 2021). The 17 SDGs, published by the United Nations in September 2015, evolved from the eight Millennium Development Goals (MDGs). These specific goals include ending extreme poverty and hunger; ensuring universal access to primary education; advancing gender equality and women's empowerment; reducing child mortality; improving maternal health; combating HIV/AIDS, malaria, and other diseases; ensuring environmental sustainability; and creating a global partnership for development (United Nations, 2020).

The 17 SDGs are to be achieved by 2030, as set out in the 2030 Agenda for Sustainable Development. These goals provide an international framework for achieving sustainable development. Sub-Saharan Africa (SSA) lags behind other regions in nearly all of the 17 SDGs—with the exception of SDG 13 (Climate Action), as observed by Ibeh and Walmsley (2021). The SDGs represent a social contract among world leaders, the people, and the planet, and they embody a shared holistic vision of humanity (United Nations, 2020). Figure 1 highlights these goals.

Figure1: Sustainable Development Goals. United Nations. (n.d.).

The goals emphasise that no one should be left behind, and because the world is interwoven, every country must be included in the journey toward a sustainable planet. The aim is to address the needs of people in both developed and developing nations to ensure the attainment of a healthy planet (United Nations, 2020).

The Agenda covers crucial issues pertaining to peace, justice, and effective institutions, as well as the three elements of sustainable development—social, economic, and environmental (United Nations, 2020). The SDGs also call on richer countries to take further steps to reduce domestic overconsumption and pollution. In order to achieve these goals, it is necessary to recognise that the poorest nations are often the most vulnerable to the impacts of climate change (Rachael, 2014).

At the African Regional Meeting (2015), it was observed that factors such as a lack of funding support, inadequate health workers, and insufficient infrastructure for service delivery are major bottlenecks in achieving health-related

MDGs. Many Sub-Saharan African nations advocate strengthening health systems to ensure universal access to primary healthcare (African Regional Meeting, 2015).

According to Emmanuel (2022), baseline indicators for each goal vary greatly among countries, reflecting disparities in access to resources to improve quality of life. This variation means that each region experiences different changes over time in the indicators used to assess progress toward the 2030 targets. As Rachael (2014) opined, the SDGs must be applied globally but implemented in accordance with local conditions and expertise. Therefore, problem solving at regional, national, and international levels must consider local specificities.

Ibeh and Walmsley (2021) note that although sustainability is a universal concept, its implementation is location-dependent. For instance, a developing economy such as Nigeria may prioritise food provision, basic infrastructure, and poverty eradication, whereas developed economies such as the United Kingdom and Germany might focus on reducing greenhouse gas emissions. Consequently, there exists an evolutionary gap between current sustainability levels and an "ideal" sustainable state.

Yet, several difficult-to-control factors—such as politics, government, and education—act as barriers to the implementation of empirically proven strategies. To overcome these challenges, it is crucial to raise awareness at global, regional, and national levels through the pivotal role of science in strategy formulation, technology development, and evidence-based policymaking (Rachael, 2014).

2.0 Data Source and Method

This research centres on the origins of the Sustainable Development Goals, drawing on a desktop synthesis of available data and information, and incorporating insights from diverse studies examining the theory and application of science and sustainable development in Sub-Saharan Africa (Emmanuel, 2022). The focus of this study is the role of science in the implementation of SDGs in SSA. Secondary resources, including large datasets and bibliometric analyses of scholarly and grey literature over the past ten years, were used to examine trends and patterns. A content analysis of the first 50 publications identified key topics and viewpoints, enabling an evaluation of Africa's challenges and potential solutions in the context of the SDGs.

3.0 Achieving Sustainable Development Goals in Sub-Saharan Africa

Camkin *et al.* (2022) note that Agenda 2030 and the SDGs face challenges not only due to the impacts of the COVID-19 pandemic but also because of the increasing disparity in access to scientific and technical resources. Science has the potential to accelerate progress by making scientific knowledge, data, and outputs more widely available (via open access) and consistently used (through open data) with the active participation of all stakeholders (Geneva Call, 2020). In this context, open research dismantles barriers to information and promotes diversity in problem solving (Camkin *et al*., 2022).

At the national level, the implementation, assessment, monitoring, and accountability processes for the 2030 Agenda are complex, particularly when weighing potential trade-offs between short-term development successes and long-term sustainability (Griggs *et al*., 2013; Rockström *et al*., 2013; Kanie *et al*., 2014). Although the SDGs provide a coordinating framework for decision-making in both the public and private sectors, science remains crucial for representing sustainability challenges in various contexts. This includes data analysis, scenario building, and monitoring progress toward the goals (Dasgupta *et al*., 2014; Beisheim *et al*., 2015; Yonglong *et al*., 2015; Nilsson, 2016; Nilsson *et al*., 2016).

In many cases, it may be necessary to prioritise the SDGs locally and regionally. Conflicting issues may necessitate difficult decisions owing to the intricate dependencies among the goals. In such circumstances, decision-makers can benefit from science's holistic approach to systems thinking. This is essential for identifying knowledge gaps, launching solutions-oriented research, and creating integrated assessments with stakeholder involvement (TFM, 2016). Research can help identify crucial interactions between policies and determine how potential negative impacts may be mitigated through synergistic solutions (Schmalzbauer & Visbeck, 2016).

4.0 Confrontations in Sub-Saharan Africa with Attaining the SDGs

The following factors have been identified as major obstacles to the implementation of the SDGs in Sub-Saharan Africa:

4.1 Difficulties Relating to Data

A major challenge for many countries in SSA is the availability and quality of data necessary to assess progress toward the SDGs (Rotimi, 2016; Ibeh & Walmsley, 2021). Inadequate data—whether due to inaccessibility, poor quality, or insufficient key performance measures—hinders effective monitoring. For example, Ibeh (2020) found that despite the significant socio-economic impacts of gully erosion and landslides in Nigeria's Odo River sub-basin, there were either poor records or no data on baseline stream flow, groundwater levels, or gully morphology.

4.2 Conflict

National instability resulting from war or terrorism poses a serious barrier. Conflict has far-reaching negative effects on all 17 SDGs. In conflict-torn regions of SSA, sustainable development is extremely difficult to achieve. Examples include the insurgencies led by the Lord's Resistance Army in Uganda, Boko Haram in Nigeria, Chad, Cameroon, and Niger, Al Shabaab in Somalia and Kenya, and others (Ibeh & Walmsley, 2021). Ongoing conflicts have even prevented countries such as Libya from submitting SDG progress reports (Index SDG, 2019).

4.3 Institutions with Weak Governance

Weak governance and corruption are widespread in SSA and contribute significantly to poor progress toward the SDGs (Rotimi, 2016; Ibeh & Walmsley, 2021). Ineffective environmental governance leads to weak institutions, inconsistent policies, and poor enforcement of laws, which in turn hinder capacity building and the effective achievement of SDG targets.

4.4 Finance

The implementation of the SDGs in SSA requires substantial financial investment. Currently, international donor organisations provide most funding; however, the resources available are significantly less than what is needed (Rotimi, 2016; Index SDG, 2019). Developing countries may require an increase in donor funding of nearly US$200 million annually for data and statistics alone (United Nations, 2020).

4.5 Changing Weather

Although many SSA nations are on track to achieve SDG 13 (Climate Action) due to low fossil fuel usage and low greenhouse gas emissions, these countries remain highly vulnerable to climate change. A lack of preparedness for extreme weather events and weak economic, social, and environmental resilience will exacerbate the effects of a changing climate (Walmsley & Husselman, 2019).

4.6 Migration and Demographics

SSA is expected to experience a significant population increase over the next 30 years. A Financial Times analysis (2019) predicts that the population will double, with an additional one billion people, potentially making SSA the most populous region in the world. The World Bank projects a tenfold increase between 1960 and 2050 (World Bank Data Catalogue, 2020). Such demographic changes will strain existing infrastructure and services, and exacerbate challenges such as waste management and migration (United Nations, 2020).

5.0 Future Vision for Sustainable Development in Africa

According to the report from the 13th African Regional Meeting (2015), Africa has the potential to be the engine that drives the 2030 Agenda forward. The continent possesses the necessary resources, favourable demographic trends, and policy latitude to play an active role in the global economy. However, a shift in policy strategy is required—one that prioritises the creation of decent work as a fundamental goal, irrespective of whether efforts are focused on

urban or rural areas, agriculture or industry. Such a strategy is essential for diversifying development and equitably distributing its benefits (African Regional Meeting, 2015).

The SDGs are also expected to drive improvements in entrepreneurship and employment creation, which are crucial for long-term economic growth and poverty eradication (SDGCA, 2017). Although many African nations have prioritised job creation, challenges remain due to insufficient progress in formalising the informal economy. The recommendations from the 12th African Regional Meeting emphasise the need for increased support for initiatives targeting poverty reduction, labour migration, social protection, and child labour (African Regional Meeting, 2015).

Beisheim *et al.* (2015) have noted that millions of the poorest and most marginalised individuals have been left behind by uneven progress. To reach these vulnerable populations, targeted measures are necessary. The SDGs address issues ranging from fair labour conditions and economic growth to zero poverty, zero hunger, good health, quality education, gender equality, clean water and sanitation, clean energy, and partnerships (United Nations, 2020).

6.0 The Main Approach to Achieving the SDGs in Sub-Saharan Africa

Compared to the MDGs, the SDGs are significantly more ambitious. While the MDGs focused on poverty eradication and health improvements, the SDGs encompass a broader scope of economic development, requiring more sophisticated solutions. Achieving the SDGs by 2030 in Africa will require:

- Evidence-based policies both domestically and internationally,
- Increased public and private funding,
- The development and adoption of new technologies, and
- Enhanced governance and accountability (SDGCA, 2017).

Below, we outline the key roles of science in various sectors:

i. Role of Science in Health

To achieve SDG 3, which calls for universal access to health care, robust health systems must be built and improved. Increased global public financing is needed to bridge gaps in health service delivery. For example, only six African nations had met the Abuja Goal (15% of annual government spending on health) as of 2013 (Dahn, 2015). Innovations such as the expansion of Community Health Workers (CHWs) can facilitate access to primary healthcare, particularly in underserved communities.

ii. Role of Science in Education

The goal of universal primary and secondary education by 2030 requires strong, IT-enabled educational systems that promote inclusion and quality learning outcomes (TFM, 2016). Assistive technologies can enhance educational inclusion, promote gender equality, reduce inequalities, and improve teacher and system capacities. Addressing the significant funding gapcurrently around US$40 billion globally for education is essential, particularly in Africa where 59 million children are out of school (TFM, 2016; SDGCA, 2017).

iii. Role of Science in Agriculture and Food Security

Despite possessing 65% of the world's arable land, Africa remains a net food importer, spending US$35 billion annually on imports (AfDB, 2016). More than 80% of agricultural land is hindered by soil fertility issues or other productivity barriers. Scientific advancements in sustainable irrigation, fertiliser use, and agro-inputs are vital to increase agricultural productivity and resilience. Given the expected 60% increase in food consumption by 2050, these interventions are crucial for sustainable growth (AfDB, 2016; SDGCA, 2017).

iv. Role of Science in Energy and Infrastructure

SDG 7 and SDG 9 call for universal access to sustainable energy and the development of resilient infrastructure. Inadequate infrastructure and energy supply cost Africa around 2% of its annual GDP growth. Scientific research in

renewable energy, coupled with enhanced infrastructure finance and expedited development plans, is necessary to meet these challenges (AfDB, 2016; SDGCA, 2017).

v. Role of Science in Information and Communication Technology

According to the Sustainable Development Goals Centre for Africa (SDGCA, 2017), ICT is a cornerstone for sustainable development in Africa. ICT impacts multiple sectors, including health, education, infrastructure, and agriculture. For instance, the mobile communications market in SSA had 367 million users in 2015, and this is expected to rise further, with broadband connections projected to increase significantly. Continued ICT expansion is essential for bridging the digital divide and ensuring that remote regions are not left behind.

vi. Role of Science in Demography

Africa's demographic profile remains a major challenge. With high fertility and mortality rates, the continent faces significant risks that affect education, infrastructure, and long-term economic development. Projections indicate that Africa's population could reach 3.8 billion by 2100, a 20-fold increase since 1950. A successful demographic transition will require improvements in family planning, female education, job creation, and poverty alleviation (SDGCA, 2017).

vii. Role of Science in Job Creation

SDG 8 promotes sustained, inclusive economic growth and productive employment. In SSA, job creation remains a critical challenge, with the working-age population expected to increase by 70% by 2030 (SDGCA, 2017). Comprehensive job-creation policies that address infrastructure, education, and vocational training are necessary to prevent de-industrialisation and achieve sustainable economic growth.

7.0 Conclusion

The provision of data, information, and knowledge necessary to support the successful implementation of the 2030 Agenda and the related SDGs requires science to play a significant role, particularly in Sub-Saharan Africa. The interconnectedness of environmental, economic, and social issues is explicitly acknowledged in the 2030 Agenda; therefore, focusing on a single objective is insufficient. To progress towards all SDGs in SSA, both science and society must consider the entire scope of the goals (Schmalzbauer & Visbeck, 2016).

8.0 Recommendations

Based on the conclusions of this study, the following recommendations are proposed to enhance the implementation of the SDGs in Sub-Saharan Africa:

- **Integrate the SDGs into Research Agendas:** Ensure that new research initiatives incorporate the 2030 Agenda and embed sustainable development goals at all levels.
- **Strengthen the Science–Policy Interface:** Establish science as a trustworthy partner in the implementation and review of policies, and create independent scientific monitoring tools to facilitate evidence-based decision-making.
- **Promote Technological Innovation:** Encourage the development and adoption of renewable energy technologies and other sustainable innovations by providing long-term funding and creating a conducive research environment.
- **Enhance Collaboration:** Foster improved collaboration among government, industry, and academic sectors to efficiently harness the power of science in achieving sustainable development.
- **Adopt an Integrated Scientific Approach:** Respect the diversity of knowledge systems and address the social, economic, and environmental dimensions of sustainable development holistically (Simone, 2017; UNESCO, 2016; United Nations, 2020).

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